

Chapter 8

Energy



ENERGY

ENERGY CONSUMPTION

Indicator 1. Energy Consumption

Background The United States is one of the highest per capita consumers of energy in the world. The American Almanac reports that while accounting for only five percent of the world's population, Americans consume 26 percent of the world's energy. In 1997, United States residents consumed an average of 12,133 kilowatt-hours of electricity each, almost nine times greater than the average for the rest of the world.

Kentucky ranks 18th in the nation in energy consumption. Energy consumption rates have been steadily increasing for the past 3 decades. The trend reflects a growing economy, a larger population and increased demand. Total Btu energy generation in Kentucky has increased by 64 percent between 1970 and 1999.

The primary energy sources in Kentucky are coal, petroleum and natural gas. Only a small portion of the energy consumed in Kentucky is considered renewable. During 1999, renewable energy (hydroelectric, solar, wind power and biomass) provided two percent of the energy consumed in the state, compared to seven percent nationwide.¹

Goal Provide for the Commonwealth's energy needs in the most efficient and cost-effective way possible while protecting the environment and conserving our natural resources.

Progress Kentucky has been outpacing the nation in the consumption of energy on a per capita basis. Since 1990, the state's per capita energy use has increased 16 percent compared to the national average of 4 percent. Kentucky ranks eighth in the nation for per capita energy use.

The most likely reason for the state's higher per capita energy use is the number of energy-intensive industries, such as aluminum, paper, chemical plants and a uranium processing facility, that are located in the state. Kentucky manufacturers also produce a large number of automobiles, which is another energy-intensive industry. In 1999, Kentucky ranked 13th in the nation in industrial energy use. Industrial energy consumption in Kentucky grew by 42 percent between 1990 and 1999, following a 107 percent growth trend during the past four decades. During 1999, petroleum accounted for 47 percent of the energy consumed by the industrial sector, followed by electricity (24 percent) and natural gas (17 percent).

During the past 39 years, commercial energy consumption in Kentucky has increased a dramatic 153 percent. The growth of energy consumption for

At a Glance

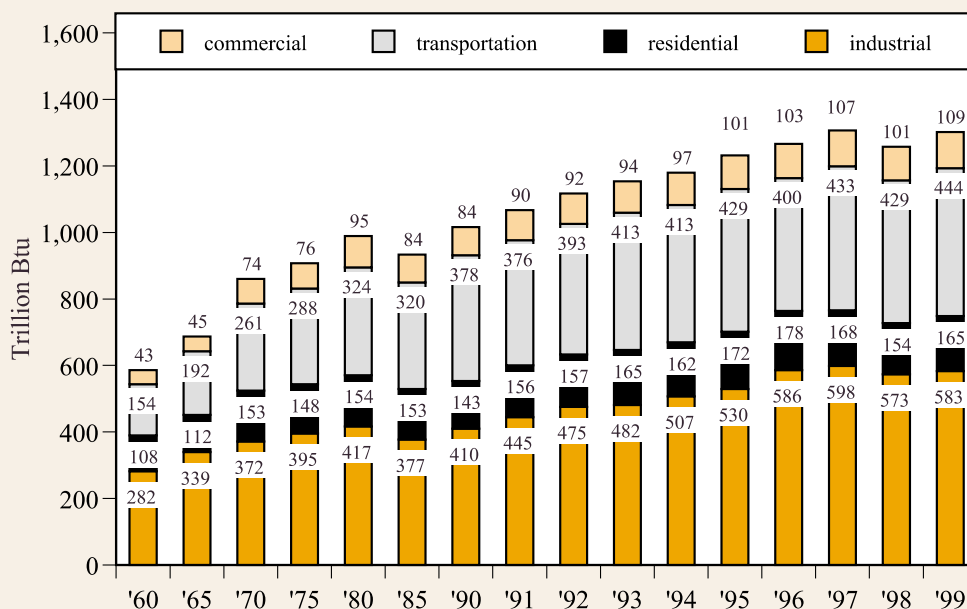
Energy production in Kentucky (trillion Btu)

1960	825
1970	1,116
1980	1,402
1990	1,417
1999	1,830

Energy sources (percent consumption - all users)

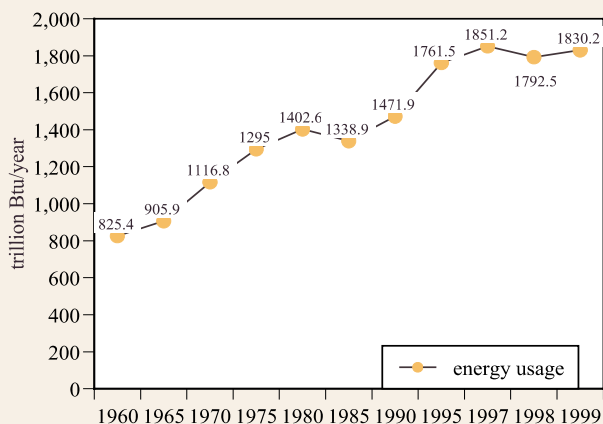
coal	48%
petroleum	40%
natural gas	12%
renewable	2%

Measure 1. Energy Consumption in Kentucky

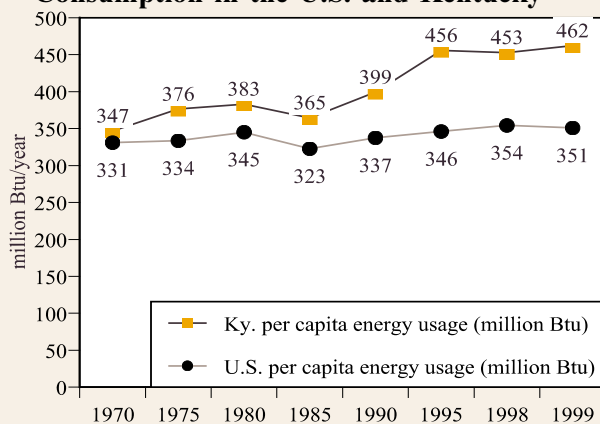


ENERGY CONSUMPTION

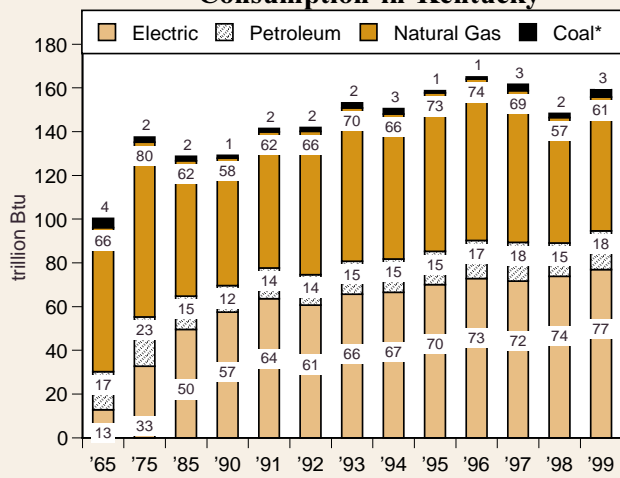
Measure 2. Total Btu Production in Kentucky



Measure 3. Per Capita Energy Consumption in the U.S. and Kentucky



Measure 4. Residential Energy Consumption in Kentucky



commercial purposes is directly related to the economy. For example, during the economic downturn of the 1980s, the state's commercial energy consumption declined by 12 percent. However, between 1990 to 1999, when Kentucky's and the nation's economy was growing, commercial energy consumption rose by 30 percent. Electricity supplied 48 percent of the commercial sector energy needs, followed by natural gas at 39 percent.

The amount of energy used in our homes increased by 15 percent between 1990 and 1999, continuing the same increasing trends seen in the past two decades. Kentucky ranks 23rd in the nation in residential energy use. The increase is linked to the state's expanding population and an increase in the size and number of houses.

In 1999, electricity supplied 46 percent of the energy consumed in our homes, followed by natural gas at 38 percent. A majority of the electricity generated in Kentucky (97 percent) is supplied by coal-fired power plants. Kentucky's power plants are the greatest consumers of energy in the

state. During the past four decades (1960 through 1999) Btu consumption by power plants increased 315 percent. During 1999, 21 coal-fired power plants consumed 804 trillion Btu of energy to generate electricity in Kentucky, an increase of 13 percent since 1990. Natural gas may play an increasing role supplying power plants with fuel in the future as coal reserves decline or become more costly to mine, demand for electricity rises, and because burning natural gas generates less air pollution. In 1999, 659 additional megawatts of electric generating capacity was added to the state's existing 15,671 megawatts. This additional capacity was all gas-fired.² The Kentucky Division for Air Quality also reports that as many as 21 new power plants may be located in Kentucky in response to demand and utility deregulation. Currently there are 18,000 megawatts of electric-generating capacity in the state. Of these, 89 percent are coal-fired. Applications have been proposed for 12,000 more megawatts. The majority of these new power plants (65 percent) will be fueled by natural gas.

Energy consumed in Kentucky for transportation use grew by 17 percent between 1990 and 1999. During the past four decades this sector has seen energy use rise by 188 percent. Kentucky currently ranks 21st in the nation in transportation energy use. This is a reflection of the increased truck traffic traveling through Kentucky; a growing number of personal

vehicle miles driven each year as Kentuckians drive greater distances to their jobs; and the popularity of larger trucks, vans and sport utility vehicles, which tend to consume more gasoline.³

Footnotes

1. State Energy Data Report 1999 and U.S. Annual Energy Report 1999, Energy Information Administration.

2. Inventory of Electric Utility Power Plants in the U.S. 1999, Table 20, Energy Information Administration.

3. Kentucky Truck Trends, Web site - <http://www.census.gov/econ/www/viusmain.html>.

Measures - notes and sources

Measure 1. 1999 data most recent available. Data has been refined since the 1992 State of Kentucky's Environment report. Does not include electrical system energy losses. Source: U.S. Department of Energy, Energy Information Administration State Energy Data Reports, 1960-99.

Measure 2. Totals will not match totals in Measure 1 because of rounding errors and additional energy losses during the production of electricity. Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Reports, 1965-99.

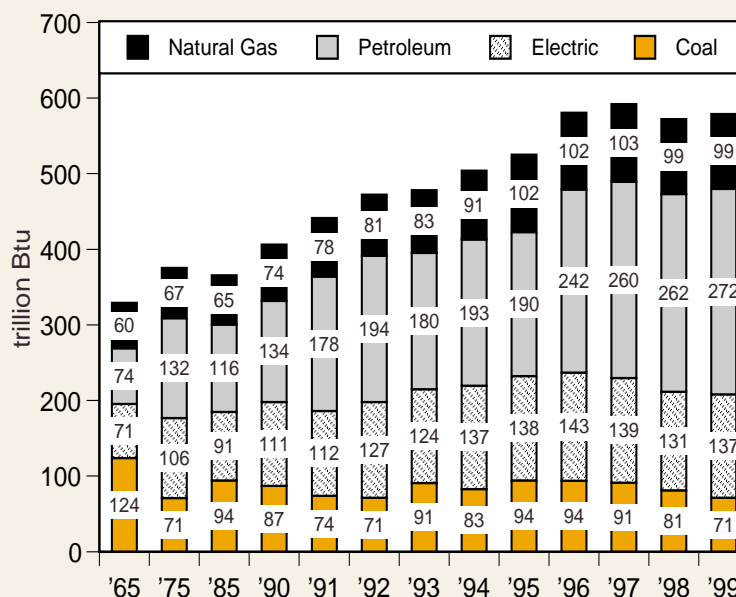
Measure 3. Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Reports, 1965-99.

Measure 4. *Direct use of coal. Does not include electrical system energy losses. Wood not listed as an energy source. Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Reports, 1960-99.

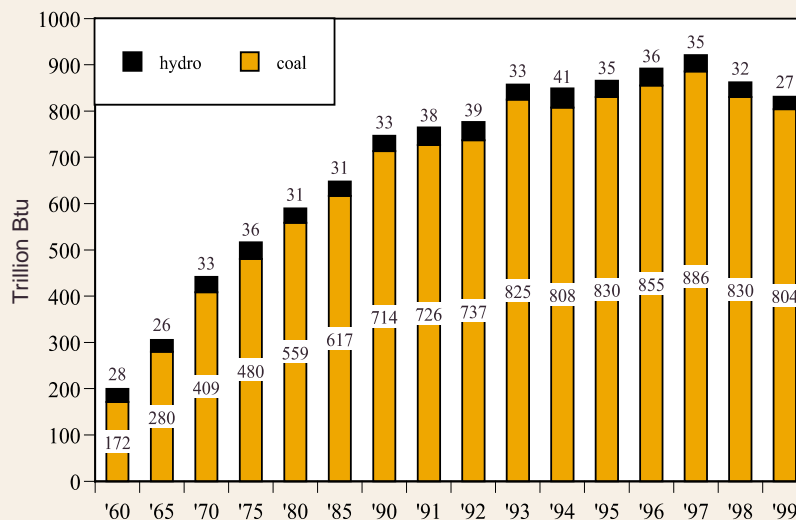
Measure 5. Does not include electrical system energy losses. Does not include wood and waste as an energy source. Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Reports, 1960-97 and U.S. Census Bureau.

Measure 6. Source: U.S. Department of Energy, Energy Information Administration State Energy Data Reports, 1960-99.

Measure 5. Industrial Energy Consumption in Kentucky



Measure 6. Electric Utility Energy Consumption in Kentucky



ENERGY PRICES & EXPENDITURES

Indicator 2. Energy Prices and Expenditures

At a Glance

Total energy expenditures in Kentucky (1997)
..... \$9 billion

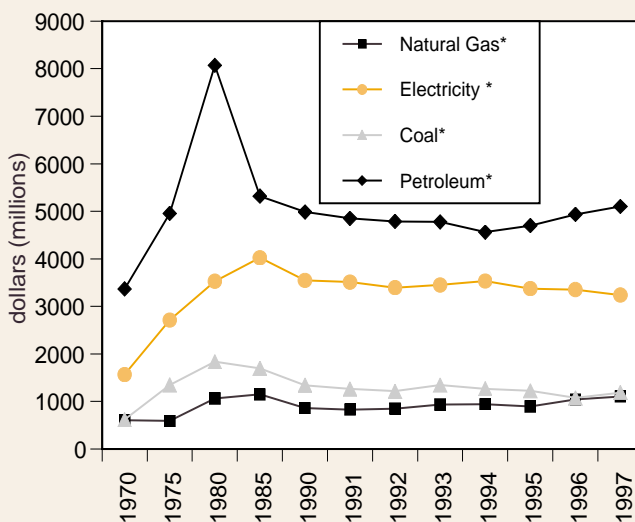
Percent of income Kentuckians spend on energy ... 5 to 15%

Background Kentuckians spent nearly \$9 billion in 1997, the most recent year data was available, for the commercial, industrial, transportation and residential use of energy.¹ It is estimated that the average Kentuckian spends 5 to 15 percent of their income on energy. The price the consumer pays for energy is dependent on factors such as production, demand, deregulation and the costs associated with energy generation and transmission.

The cost of energy can greatly influence consumption patterns. The price of petroleum, natural gas and coal increased during the "energy crisis" era between 1970 and the mid-1980s. Since then, the prices for these fuels leveled out. But in 2000 and 2001, reduced supplies of natural gas and gasoline led to price increases in Kentucky and the nation.

Goal Provide for the Commonwealth's energy needs in the most efficient and cost-effective way possible while protecting the environment and conserving our natural resources.

Measure 1. Energy Expenditures in Kentucky

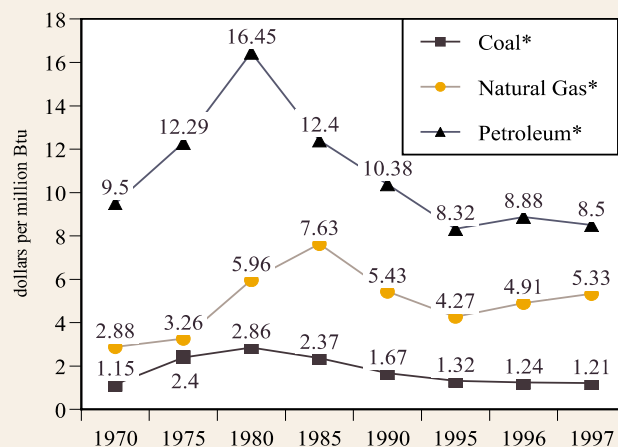


Progress Transportation-related expenditures accounted for 35 percent (nearly \$3.6 billion) of the \$9 billion spent by Kentuckians for energy in 1997. Energy expenditures for petroleum have remained fairly level since 1995, but have since increased 8 percent between 1995 and 1997. Average gasoline prices in Kentucky have fluctuated greatly during the last two decades due to supply shortages, wholesale prices, increased demand and other factors. The highest average gasoline prices recorded to date were in 1980. However, gas prices in 2001 have risen due to supply disruptions brought about by high winter heating oil demand and breakdowns in production of reformulated gasoline.²

Total electricity expenditures have remained steady during the 1990s. Average electric rates in Kentucky are still among the lowest in the nation due to the proximity of coal resources. In 1999, the average electric price in Kentucky per kilowatt hour was 5.8 cents compared to the national average of 8.6 cents.³

Controlling air pollutants emitted by coal-fired power plants, Kentucky's primary source of electricity, has also added to the cost of producing electricity. Some utilities have imposed environmental surcharges on customers and others are seeking approval to do so. For example, Kentucky Utilities and Louisville Gas and Electric have a 5.6 percent environmental surcharge to recover costs associated with scrubbers and other equipment to control sulfur dioxide emissions. These companies have also requested that the Kentucky Public Service Commission amend their existing environmental surcharges to recover the cost of complying with nitrogen oxide (NOx) provisions of the federal Clean Air Act. These utilities are proposing to install selective catalytic reduction (SCR) systems at 12 of their boilers at a cost of \$500 million. The Tennessee Valley Authority (TVA) has also taken steps to control air pollution by installing SCR

Measure 2. Energy Rates in Kentucky



systems at its Paradise Power Plant located in Muhlenburg County. This system is the first of 13 to be installed by TVA as part of a \$750 to \$800 million emissions reduction program. Once complete, these systems, plus boiler optimization controls and the operation of low-NOx burners, will reduce TVA's overall emissions of NOx by 70 to 75 percent. The utility is also decreasing its sulfur dioxide emissions by switching to low-sulfur coal and operating scrubbers at three plants.

Natural gas expenditures in Kentucky were level between 1991 and 1995, but began to rise in 1996. However, prices have since soared to record levels. Between January 2000 and January 2001, the average nationwide price of natural gas increased 70 percent.⁴ In Kentucky, prices rose 50 percent. Natural gas prices have increased due to a decrease in supply resulting from low prices in past years and an increase in demand as several natural gas power plants began operations, coupled with a cold winter. Because natural gas prices have been low for several years, there has been little incentive to drill and explore for natural gas, according to state energy officials.

Deregulation has also impacted natural gas prices and supplies in certain states where restructuring and deregulation has occurred, particularly in California. The goal of deregulation is to stimulate growth and help lower electric rates by opening up electric markets to competition. The Kentucky General Assembly established a task force in 1998 to study the electric deregulation issue and concluded that there was little immediate demand for major structural changes in Kentucky's electric industry, especially given the failure of California's electric industry deregulation.

Footnotes

1. State-Level Energy Consumption, Expenditures, and Prices, 1997, Table 1.6, Energy Information Administration.
2. "What's driving higher gas prices in 2001," Alliance to Save Energy.
3. Electric Power Annual, Table A22: Retail Sales of Electricity, Revenue, and Average Revenue per Kilowatt-hour, Energy Information Administration.
4. "Residential Natural Gas Prices: What Consumers Should Know," Energy Information Administration, January 2001.

Measures - notes and sources

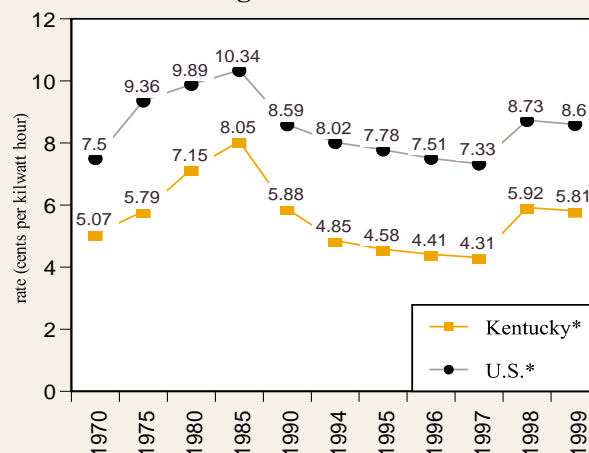
Measure 1. *Adjusted for inflation using consumer price index for 2000. 1997 most recent data available. Source: U.S. Department of Energy, Energy Information Administration, Energy Data Reports 1970-97.

Measure 2. *Adjusted for inflation using consumer price index for 2000. 1997 most recent data available. Source: U.S. Department of Energy, Energy Information Administration, Energy Data Reports 1970-97.

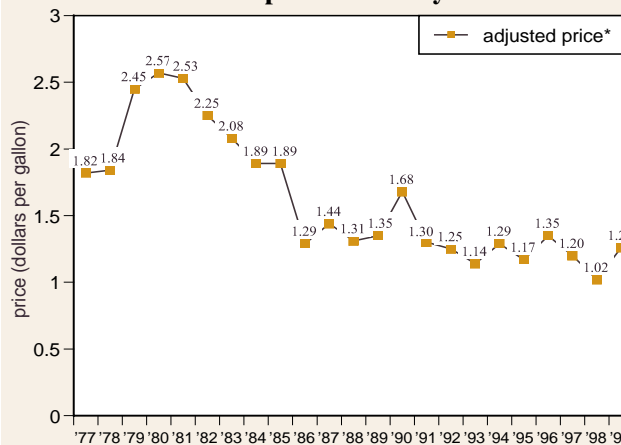
Measure 3. *Adjusted for inflation using consumer price index for 2000. Source: U.S. Department of Energy, Energy Information Administration, Energy Data Reports 1970-97.

Measure 4. *Prices are based on average pump costs on December 17 for self-serve, regular unleaded gasoline. All numbers are adjusted for inflation using consumer price index for 2000. Source: American Automobile Association, Louisville Office, 2000.

Measure 3. Average Residential Electric Rates



Measure 4. Gasoline Prices at the Pump in Kentucky



TRANSPORTATION

At a Glance

Gasoline consumed for transportation
1980. . . 1.6 billion gal.
1990. . . 1.7 billion gal.
1999. . . 2.1 billion gal.

Number of vehicles registered in Kentucky
1970 1.8 million
1980 2.7 million
1990 2.9 million
2000 3.4 million

Average number of miles driven per person in Kentucky
1970. 6,210
1989. 9,217
1999. 12,072

Indicator 3. Energy and Transportation

Background Transportation accounts for 24 percent of all energy used in the state. Kentuckians consumed 2.1 billion gallons of gasoline for transportation activities in 1999, an increase of 20 percent since 1990. This short-term rise is typical of a long-term trend that reflects a 51 percent increase in gasoline consumption since 1970.

Goal Provide for the Commonwealth's energy needs in the most efficient and cost-effective way possible while protecting the environment and conserving our natural resources.

Progress The number of passenger vehicles registered with the state has increased 86 percent since 1970 and now numbers 3.4 million.¹ According to the Kentucky Transportation Cabinet, Kentuckians have doubled the average number of miles driven each year for personal travel as compared to 1970. In 1999, the average person in Kentucky traveled nearly 12,072 miles. Although the number of miles traveled has increased, the amount of gasoline consumed per vehicle has generally been declining since 1970, a result of improved fuel efficiency of vehicles. However, this trend began to reverse itself in the early 1990s with the

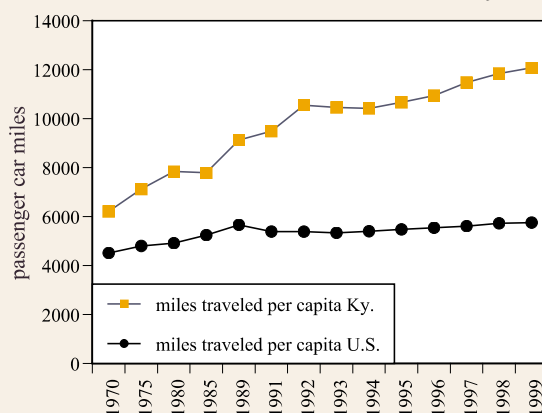
popularity of less fuel-efficient vans, trucks, and sport utility vehicles. This category of vehicles has increased nationwide by 89 percent since 1985.

The use of cleaner, renewable fuels is an important component of federal strategies to curb air pollution, reduce U.S. dependence on foreign oil, and control emissions from burning fossil fuels that are associated with acid rain and global warming. Kentucky now has 33 refueling stations for compressed natural gas, ethanol and liquid propane gas. The U.S. Department of Energy estimates that there are 5,735 alternative-fueled vehicles in the state, an increase of 31 percent over 1998 levels.²

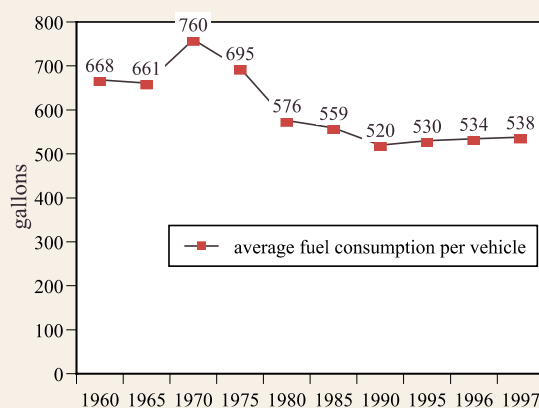
The national Energy Policy Act of 1992 requires state fleets to purchase vehicles powered by alternative fuels such as ethanol, methanol, natural gas, propane, electricity or biofuels. As of 2000, 75 percent of all new state government fleet purchases are alternatively fueled vehicles. The Kentucky Division of Energy has recommended the state apply these requirements to all state vehicle purchases.

The nationwide use of ethanol as an alternative fuel has in-

Measure 1. Per Capita Vehicle Miles Traveled in the U.S. and Kentucky



Measure 2. Average Fuel Consumption Per Vehicle in the U.S.



creased 250 percent since 1992.³ However, this is still only a small fraction of the transportation fuels used in the United States. Ethanol is produced from corn and other biomass and is used as a clean burning fuel supplement that is blended with gasoline to produce "gasohol." Gasohol is higher in oxygen content and burns cleaner than gasoline. The American Farm Bureau estimates farmers and other agricultural businesses could increase their earnings annually by as much as \$4.5 billion if ethanol use were significantly expanded.⁴ Approximately 950 Kentucky state government vehicles are capable of operating on a formula of 85 percent ethanol and 15 percent gasoline.⁵ There are currently seven ethanol refueling stations in the state, most of which are in central Kentucky and Louisville.

A factor that will likely lead to the increased use of ethanol is the removal of Methyl Tertiary Butyl Ether (MTBE) from gasoline. National concerns regarding the use of reformulated gasoline were raised after MTBE—one of two fuel oxygenates used in reformulated gas to help improve air quality—was detected in groundwater. The U.S. Environmental Protection Agency (EPA) classifies MTBE as a possible human carcinogen. Reformulated gasoline with MTBE is used in Louisville and in northern Kentucky. The U.S. EPA has called for a nationwide phase out of MTBE. If MTBE were replaced with ethanol, the demand for ethanol could increase from 1.3 billion gallons in 2000 to 3.2 billion gallons in 2004.⁶ Kentucky has one ethanol plant, which is located in Louisville (Parallel Products makes ethanol from beverage and food waste). The Hopkinsville Elevator Company has applied for a grant to build a new ethanol plant in Hopkinsville.

The *Clean Cities* Program is a national program aimed at reducing air pollution caused by vehicle emissions. The program emphasizes the use of alternative transportation fuels to improve air quality and reduce dependence on imported oil. In 1993, the City of Louisville and Jefferson County created a partnership with local businesses and government agencies to become the nation's 19th "Clean City." The criteria for becoming a "Clean City" includes committing to accelerated use of alternative fuels in fleet vehicles and promoting partnerships to create the infrastructure needed to support alternatively fueled vehicles. There are currently 80 clean cities in the country.

Footnotes

1. *Kentucky Transportation Cabinet, May 4, 2001.*
2. *Alternatives to Traditional Transportation Fuels 1998, Table 3, U.S. Department of Energy.*
3. *U.S. Refueling Site Counts by State and Fuel Type as of November 20, 2000, U.S. Department of Energy, Alternative Fuels Data Center.*
4. "Ethanol Can Help End the Grumbling," by C. David Kelly, *American Farm Bureau Federation*, July 17, 2000.
5. *Ky. Division of Energy, December 2000.*
6. "Ability of the U.S. Ethanol Industry to Replace MTBE," by John Urbanchuk, executive vice president, *AUS Consultants*, March 20, 2000.

Measures - notes and sources

Measure 1. Source: U.S. Department of Transportation, *Highway Statistics Summary and Annual Vehicle Survey*; U.S. Census Bureau.

Measure 2. Source: U.S. Department of Transportation, *Ky. Transportation Cabinet*, U.S. Census Bureau.

ENERGY CONSERVATION

At a Glance

Energy efficiency in Kentucky (Btus used to produce \$1 of state gross product)

1980.....	38,334
1990.....	21,789
1997.....	17,832

Energy lost in the electrical generation and transmission process (trillion Btu)

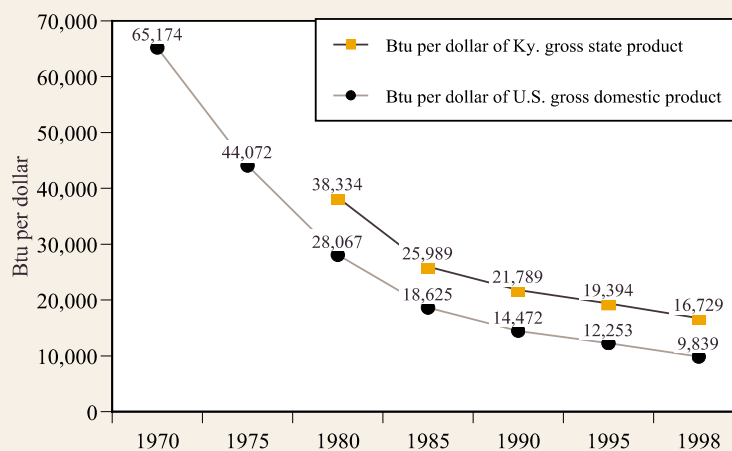
1990.....	405.4
1999.....	528.8

Indicator 4. Energy Efficiency and Conservation

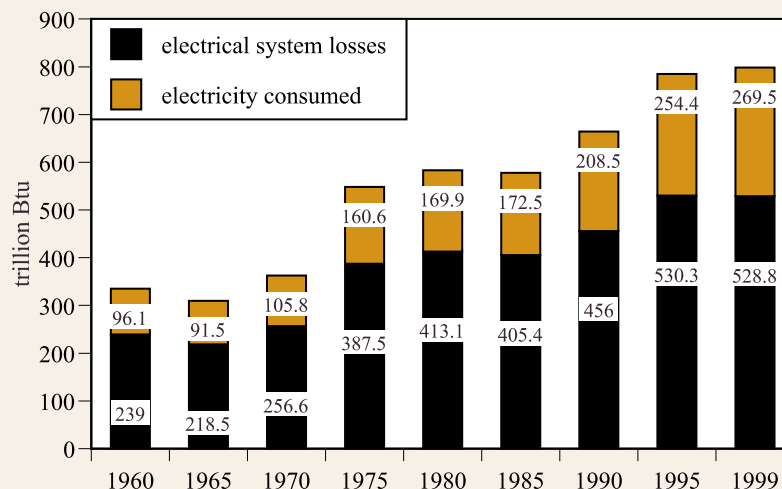
Background For many Kentuckians, the connection between energy, economics and the environment is becoming ever more clear. Volatile natural gas and gasoline prices, combined with environmental concerns such as global warming associated with burning of fossil fuels, has brought the issue of energy back to the national agenda. The Bush administration's national energy policy released in May 2001, emphasizes increased energy production from domestic sources. The policy documents that conservation and energy efficiency are important elements of a sound energy policy. However, the policy offers few incentives to improve energy efficiency, according to a number of critics. This and other energy issues will be subject of congressional debate throughout the year.

Goal Provide for the Commonwealth's energy needs in the most efficient and cost-effective way possible while protecting the environment and conserving our natural resources.

Measure 1. Energy Efficiency - Btus Used to Produce a Dollar of Product



Measure 2. Electrical System Losses in Kentucky



Progress Energy efficiency is the ability to use less energy to produce the same amount of lighting, heating, transportation and other energy services.¹ One measure of energy efficiency is energy intensity—the amount of energy it takes to produce a dollar of gross domestic product.² While Kentucky uses more energy than the national average, it has been following the national trend towards greater energy efficiency. For example, in 1997 Kentucky used 56 percent less energy to produce a dollar of Gross State Product than it did back in the 1980s. Gains in energy efficiency are attributed to technological improvements and better management practices. For example, new home refrigerators use about one third less energy than they used in 1972. The ENERGY STAR program was created by the U.S. EPA in 1992 as a voluntary labeling program designed to promote energy-efficient products in order to reduce carbon dioxide emissions. ENERGY STAR has expanded to cover new homes, most of the building sector, residential heating and cooling equipment, major appliances, office equipment, lighting and consumer electronics. There are 22 Energy Star Partners in Kentucky and one ENERGY STAR building (Aegon Center in Louisville). Aegon Center is a 35-story office building built in 1993 in downtown Louisville. Aegon Center received an Energy Star Label because of the use of highly efficient lighting systems. The building also has advanced climate control systems, which include variable speed drives on all of its air handling units, allowing the energy consumed to vary with demand.

But more can be done to improve energy efficiency and conservation in Kentucky, according to state officials. They indicate that the present rate setting structure provides a powerful incentive for utilities to sell more electricity. Additional measures are needed to encourage utilities to promote consumer efficiency.

State officials also point to the problem of energy loss during the production and transmission of electricity. For example, during 1999 only about 34 percent of the energy generated by large power plants is delivered to the consumer. The remaining 66 percent of the electricity generated was primarily lost due to the inherent inefficiencies in the conversion of fuel to useful energy. Energy is also lost during transmission of energy but accounts for only a small portion, about 5 percent, of the energy lost. Some energy is also used to operate pollution control equipment at power plants. Although 66 percent is a large loss, this is an improvement over previous years. For example, energy losses averaged 71 percent from 1960 through 1990.

Some efforts are underway to assist industries reduce energy waste. A new initiative of the Kentucky Division of Energy, funded by two grants from the U.S. Department of Energy, is the *Kentucky Industries of the Future* Project. Certain energy-intensive industries, including aluminum, steel, mining, chemicals, agriculture, metal casting and forest products, will jointly pursue projects that improve the energy efficiency of their industrial processes and reduce the amount of waste and pollution generated.

Kentucky has also initiated the Energy Efficiency in Government Buildings Program. This program provides technical assistance to help retrofit government buildings to improve energy efficiency and provide help with the operation and maintenance of the systems. The Ky. Division of Energy also administers the Institutional Conservation Program, which helps nonprofit schools and hospitals make improvements in the energy efficiency of their buildings.

Footnotes

1. *National Energy Policy, Chapter 4, Using Energy Wisely*, National Energy Policy Development Group, May 2001.
2. *Ibid.*
3. 1997, Table 119, *Energy Information Administration*.

Measures - notes and sources

Measure 1. Based on Btu's required to produce a dollar of gross state product. Adjusted for inflation using the consumer price index for 2000. 1998 most recent data available. Source: Bureau of Economic Analysis, *National and Regional Income and Product Accounts Data*, Energy Information Administration; U.S. Census Bureau.

Measure 2. Losses incurred in the generation, transmission, and distribution of electricity plus plant use and unaccounted for electrical system energy losses. Source: *State Energy Data Report 1999*, Energy Information Administration.